REMARKS

The foregoing amendments are responsive to the May 8, 2007 Office Action. Applicant respectfully request reconsideration of the present application in view of the foregoing amendments and the following remarks.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Comment

Applicant has modified Claim 1 to remove the language involving M and N to make the claim more easily readable. The special case where N=1 has been removed from Claim 1 and put into a new claim, Claim 55.

Response to Rejection of Claim 39 Under 35 U.S.C. 112, Second paragraph

The Examiner rejected Claim 39 under 35 U.S.C. 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Claim 39 has been canceled.

Response to Rejection of Claims 1-22, 34-37 and 39-54 Under 35 U.S.C. 101

The Examiner rejected Claims 1-22, 34-37 and 39-54 under 35 U.S.C. 101 because the invention disclosed in the claims are directed to non-statutory subject matter.

Applicant argues that the invention has a practical application, as it provides a more efficient method of computation. Also, the claims have been amended to recite a second practical application, the computation of a physical effect due to a physical source. Furthermore, these claims do not "preempt every substantial application" since they do not preempt applications to image compression.

Response to Rejection of Claims 1-22, 34-37 and 40-54 Under 35 U.S.C. 102(b)

The Examiner rejected Claims 1-21, 34-37 and 40-54 under 35 U.S.C. 102(b) as being anticipated by Canning et al., Rockwell Inst. Sci. Center, "Fast Direct Solution of Standard

Moment-Method Matrices," IEEE Antennas and Propagation Magazine, June 1998, pages 15-26, hereafter referred to as Rockwell.

In Section 10-3 of the current Office Action, the Examiner states (Page 17, lines 5-8) (Statement (1)),

> "Because applying Rockwell's singular value decomposition method and Lanczos Bi-diagonalization method is suggested by the Applicant to find composite sources and composite testers all the distinctions argued by the Applicant in applying SVD are anticipated by Rockwell reference either explicitly disclosed or implicitly inherent."

In Section 10-4 of the Current Office Action, the Examiner states (Page 18, lines 9-15) (Statement (2)),

> "Applicant's arguments (4) and (8) are not persuasive. Although both referenced as Rockwell's matrix A in the Office Action, the Examiner considers there are two different rectangular matrices representing the matrix of transmitted disturbances and the matrix of received disturbances respectively. Furthermore, Rockwell's singular value decomposition method or Lanczos Bi-diagonalization method is also applied to the different matrix A respectively. Therefore, the data used in finding a composite source and in finding a composite tester is different."

Applicant's detailed response to these statements has three parts:

(i) Within Statement (2) Examiner states, "Therefore the data used in finding a composite source and in finding a composite tester is different." Applicant asserts that this is an incorrect interpretation of the prior art paper Rockwell. As explained below, Rockwell uses the same data for finding groups of sources and testers.

(ii) Applicant asserts that the claimed composite sources and composite testers do not correspond to the transformed sources and transformed testers of Rockwell. Graphs are presented below that illustrate their different properties.

(iii) Within (1) the Examiner appears to argue first that the claimed composite sources and composite testers are the same as the transformed sources and transformed testers of Rockwell. Second, the Examiner observes that one utilizes a similar mathematical tool in computing them, and third concludes that therefore the methods must be the

same. In view of (ii), Applicant argues that the claimed methods are patentably distinct from the method of Rockwell.

<u>Regarding Applicant's Assertion (i)</u>

Regarding issue (i), the Examiner stated about Rockwell in Statement (2), "Therefore the data used in finding a composite source and in finding a composite tester is different." Applicant respectfully asserts that this statement is contrary to the content of Rockwell. Rockwell discloses transformed sources and transformed testers that are produced together using a matrix A and then these transformed sources and transformed testers are used together to compress A. As the Examiner has stated, Rockwell used a singular value decomposition (SVD)

$$\mathbf{A = U\,D\,V^h}$$

This SVD produces

$$A = \begin{bmatrix} | & | & | & & | \\ \mathbf{u}_1 & \mathbf{u}_2 & \mathbf{u}_3 & & \mathbf{u}_n \\ | & | & | & & | \end{bmatrix} \begin{bmatrix} \mathbf{s}_1 & & & & \\ & \mathbf{s}_2 & & & \\ & & \mathbf{s}_3 & & \\ & & & & \\ & & & & \mathbf{s}_n \end{bmatrix} \begin{bmatrix} \text{———} & \mathbf{v}_1 & \text{———} \\ \text{———} & \mathbf{v}_2 & \text{———} \\ \text{———} & \mathbf{v}_3 & \text{———} \\ & & \\ \text{———} & \mathbf{v}_n & \text{———} \end{bmatrix}$$

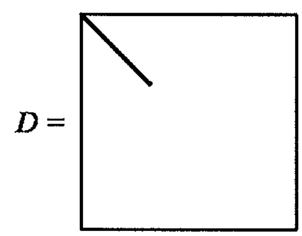
This may be represented equivalently as

$$\mathbf{A = u_1\, s_1\, v_1^{\,h} + u_2\, s_2\, v_2^{\,h} + \ldots + u_p\, s_p\, v_p^{\,h}}$$

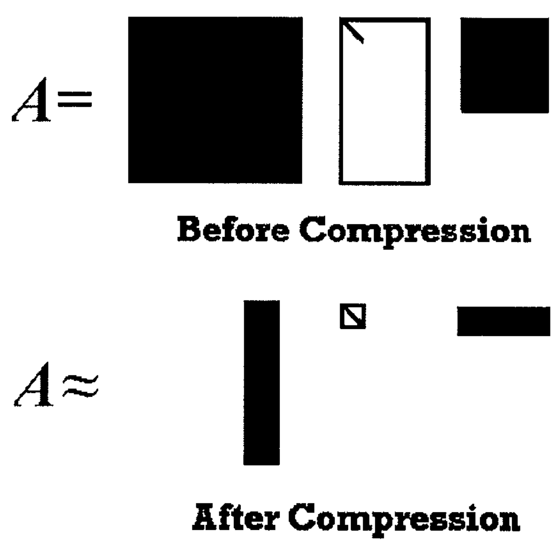
Notice that in this embodiment, one SVD is used to create pairs of new functions, and the k-th pair is (u_k, v_k). Rockwell taught that the series given above for **A** may be truncated to use fewer than *p* pairs of functions, providing an approximation to **A**. Notice that the *k*-th pair, $(\mathbf{u_k}, \mathbf{v_k})$, has two functions which are always used together to provide a compressed representation

of this same matrix A. This is contrary to Examiner's statement, "Therefore the data used in finding a composite source and in finding a composite tester is different."

Truncating the series for A given above is equivalent to approximating some of the diagonal elements of D by zero. This gives D the form shown below.



The SVD of Rockwell provides a representation of A as the product of three matrices. When D is truncated as above, this representation reduces to the form shown schematically below. Because there are zero elements on the diagonal of D, this reduces to the compressed form shown in the lower part of the figure below.



Storing these smaller matrices plus the diagonal elements requires less storage than for the original block. This creates a sparse representation of A, since these three matrices together require less storage than A and since their product gives an approximate reconstruction of A.

Thus, Rockwell creates pairs of functions u and v that must be used together. Furthermore, Rockwell uses the data in A to create pairs of transformed basis and testing functions that are used together to compress A. Thus, applicant respectfully disagrees with Examiner's statement,

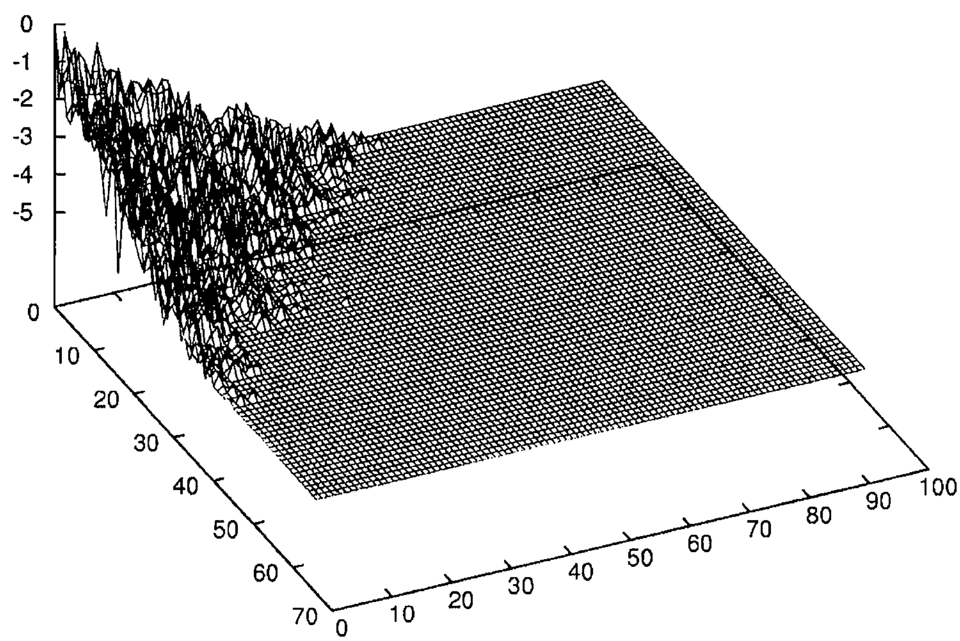
> "Furthermore, Rockwell's singular value decomposition method or Lanczos Bi-diagonalization method is also applied to the different matrix A respectively. Therefore, the data used in finding a composite source and in finding a composite tester is different."

<u>Regarding Applicant's Assertion (ii)</u>

Rockwell does not teach or suggest a block $\mathbf{Z}_{p,q}$ of an interaction matrix may be written (see Pages 24-26 of the Application as filed):

$$\mathbf{T}_{p,q} = \mathbf{d}_p^{\,L}\, \mathbf{Z}_{p,q}\, \mathbf{d}_q^{\,R} \qquad \text{, where } \mathbf{d}_p^{\,L} \text{ and } \mathbf{d}_q^{\,R} \text{ are computed separately.}$$

An example of the structure one might find for $T_{p,q}$ was shown in Figure 12 of the application.

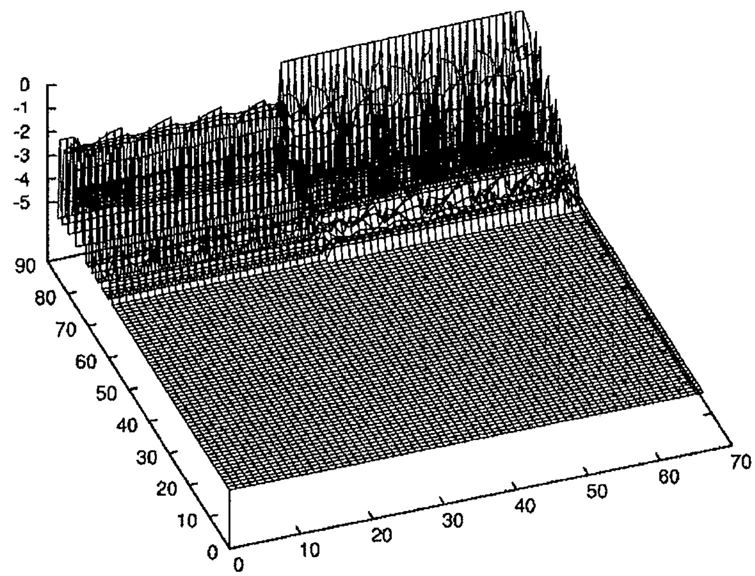
$T_{p,q} =$ 

Notice that $\mathbf{T}_{p,q}$ has a very different structure than the truncated diagonal matrix **D** from Rockwell illustrated above. The reason for the difference is that the composite basis and

composite testing functions may be created separately, (by contrast, Rockwell teaches that the composite sources and testers cannot be created separately).

Rockwell does not teach or suggest that computing composite basis functions and composite testing functions separately allows the possibility that the testing functions are changed but the basis functions are not (and vice versa), while compression is still achieved. Page 25 of the Application as filed (lines 24-28) stated, "The formula $\mathbf{V}^h \mathbf{A}^t = \mathbf{D}\ \mathbf{U}^h$ shows that $\mathbf{V}^h A^t$ will also have successive rows that tend to become smaller. The choices described above suggest that successive rows of each block of the compressed matrix will also have that property." When composite testing functions are used without a significant change in the basis functions, and an example of the resulting $\mathbf{T}_{p,q}$ is

$T_{p,q}=$



Again, this is significantly different from the truncated diagonal matrix **D** shown above.

Regarding Applicant's Assertion (iii)

Rockwell described using the data of a matrix **A** to produce transformed basis functions and transformed testing functions which, when used together, can produce a compressed representation of **A**. Rockwell does not teach or suggest using a first data to produce composite

basis functions and using a second data to produce composite testing functions that may be used together to compress **A** (where the first and second data are not identical).

In Rockwell, sub-matrices of a larger matrix were each replaced by a sparse representation. Thus, one obtained the type of representation shown below. Notice that each sub-matrix contained its own new **U** and **V** matrix. This was inefficient. In contrast to the method of Rockwell illustrated below, some embodiments of the present invention allow the use of the same matrix V in compressing multiple sub-matrices, providing additional efficiencies.

$U_{11}Z_{11}V^h_{11}$	$U_{12}Z_{12}V^h_{12}$	$U_{13}Z_{13}V^h_{13}$	$U_{14}Z_{14}V^h_{14}$	$U_{15}Z_{15}V^h_{15}$
$U_{21}Z_{21}V^h_{21}$	$U_{22}Z_{22}V^h_{22}$	$U_{23}Z_{23}V^h_{23}$	$U_{24}Z_{24}V^h_{24}$	$U_{25}Z_{25}V^h_{25}$
$U_{31}Z_{31}V^h_{31}$	$U_{32}Z_{32}V^h_{32}$	$U_{33}Z_{33}V^h_{33}$	$U_{34}Z_{34}V^h_{34}$	$U_{35}Z_{35}V^h_{35}$
$U_{41}Z_{41}V^h_{41}$	$U_{42}Z_{42}V^h_{42}$	$U_{43}Z_{43}V^h_{43}$	$U_{44}Z_{44}V^h_{44}$	$U_{55}Z_{45}V^h_{44}$
$U_{51}Z_{51}V^h_{51}$	$U_{52}Z_{52}V^h_{52}$	$U_{53}Z_{53}V^h_{53}$	$U_{54}Z_{54}V^h_{54}$	$U_{55}Z_{55}V^h_{55}$

Accordingly, Applicant asserts that Rockwell does not teach or make obvious the invention claimed in Claims 1-22, 34, 36-37, and 40-54, and Applicant requests allowance of Claims 1-22, 34, 36-37, and 40-54.

Summary

Applicant respectfully assert that Claims 1-22, 34, 36-37, and 40-55 are allowable over the prior art, and Applicant request allowance of Claims 1-22, 34, 36-37, and 40-55. If there are any remaining issues that can be resolved by a telephone conference, the Examiner is invited to call the undersigned attorney at (949) 721-6305 or at the number listed below.

Respectfully submitted,

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Dated: August 8, 2007

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